AMENDMENTS TO THE CLAIMS

Listing of claims:

Following is a listing of all claims in the present application, which listing supersedes all previously presented claims:

1. (Currently Amended) A solid-state image pickup device, comprising:

a semiconductor substrate having a two-dimensional plane on a surface thereof;

photoelectric converter elements formed in or on said two-dimensional plane ~~arranged~~ in a matrix configuration having rows and columns, wherein (m*n) rows of said photoelectric converter elements form a set, where m and n are integers greater than one ~~and formed in said two-dimensional plane~~;

one vertical charge transfer channel region formed in said semiconductor substrate for each of the columns of said photoelectric converter elements, adjacent to said each column;

two charge transfer electrodes so disposed over said vertical charge transfer channel regions for each of the rows of said photoelectric converter elements as to intersect said vertical charge transfer channel regions;

an array of color filters ~~each of which is~~ formed ~~for each of~~ above said photoelectric converter elements, said array including color filters of a plurality of colors arranged in a repeating pattern in the column direction, said repeating pattern comprising a unit of n rows, and said color filters being formed in a one-to-one correspondence with said photoelectric converter elements ~~over said each photoelectric converter element, said array including color layouts each of which includes n rows of said color filters~~; and

a drive circuit ~~for~~ capable of conducting a symmetric readout operation in ~~which~~ each set of (m*n) rows of photoelectric converter elements, wherein rows read-out by said symmetric readout operation are symmetrically distributed in the column direction of said array ~~are classified as one set, a plurality of units of photoelectric converter element rows which are symmetrically distributed are respectively selected from said sets of photoelectric converter element rows, and electric charge is read from said plural units of photoelectric converter element rows to be fed to said vertical charge transfer channel regions~~,

said symmetric readout operation comprising:

a first readout operation for reading first electric charges ~~charge~~ from a first group of photoelectric converter element rows which have an asymmetric distribution with respect to any one row of the first group, into said vertical charge transfer channel regions;

a ~~j-row~~ jxn-rows transfer operation for transferring the read-out first electric charges ~~charge for~~ [[j]] jxn rows after said first readout operation, where j is an integer greater than one; and

a second readout operation for reading second electric charges ~~charge~~ from a second group of photoelectric converter element rows which have an asymmetric distribution with respect to any one row of the second group, at positions jxn rows downstream of the rows of said first read-out operation ~~to which the electric charge is transferred by said j-row transfer operation~~, into said vertical charge transfer channel regions, to respectively add ~~and for adding~~ the read-out second electric charges to the transferred first electric charges in said vertical charge transfer channel regions, each

one of said read-out second electric charges being added to a respective one of said transferred first electric charges of a same color,

said first and second readout operations being capable of reading electric charges ~~charge~~ from two rows ~~included in~~ of one unit of photoelectric converter element rows.

2. (Currently Amended) The solid-state image pickup device according to claim 1, wherein:

said n is two;

said j ~~m~~ is m/2 ~~four~~; and

~~said selected units selected by~~ said symmetric readout operation ~~are~~ reads two units per said set.

3. (Currently Amended) The solid-state image pickup device according to claim 2, wherein:

said m is four;

said symmetric readout operation reads ~~selected units are obtained from~~ every second unit;

said first readout operation ~~is conducted for~~ reads a second row of a ~~first selected~~ first unit and ~~for~~ a first row of a second ~~selected~~ unit; and

said second readout operation ~~is conducted for~~ reads a first row of said ~~first selected~~ first unit and ~~for~~ a second row of said second ~~selected~~ unit.

4. (Currently Amended) The solid-state image pickup device according to claim 1, wherein:

said n is three;

said m is six;

said ~~selected units are~~ symmetric readout operation reads three units per said set;

said drive circuit is capable of conducting after said second readout operation:

another jxn-rows ~~a j-row~~ transfer operation for transferring the added electric charges ~~charge for~~ [[j]] jxn rows; and

a third readout operation for reading third electric charges ~~charge~~ from a third group of photoelectric converter element rows which have an asymmetric distribution with respect to any one row of the group, at positions jxn rows downstream from the rows of said second readout operation ~~to which the electric charge is transferred by said j-row transfer operation~~, into said vertical charge transfer channel regions, ~~and for adding~~ to respectively add the read-out third electric charges ~~charge~~ to ~~each other~~ the transferred added charges in said vertical charge transfer channel regions.

5. (Currently Amended) The solid-state image pickup device according to claim 4, wherein:

said ~~selected~~ three units read out by the symmetric readout operation are ~~obtained from~~ distributed every second unit;

said first readout operation ~~is conducted for~~ reads mutually different rows of ~~selected~~ first, second, and third units; and

said first, second, and third readout operations read electric charge from a first row, a second row, and a third row of said ~~selected~~ first, second, and third units, respectively.

6. (Currently Amended) A method of controlling a solid-state image pickup device comprising a semiconductor substrate having a two-dimensional plane on a surface thereof, photoelectric converter elements arranged in a matrix configuration having rows and columns, and formed in or on said two-dimensional plane, wherein (m*n) rows of said photoelectric converter elements form a set, where m and n are integers greater than one, one vertical charge transfer channel region formed in said semiconductor substrate for each of the columns of said photoelectric converter elements, adjacent to said each column, two charge transfer electrodes so disposed over said vertical charge transfer channel regions for each of the rows of said photoelectric converter elements as to intersect said vertical charge transfer channel regions, and an array of color filters ~~each of which is~~ formed above ~~for each of~~ said photoelectric converter elements ~~element~~ in one-to-one correspondence to ~~over~~ said ~~each~~ photoelectric converter elements ~~element~~, said array including color filters of a plurality of colors, and having repetitive units of layout along the column direction, ~~color layouts~~ each unit being composed of ~~which includes~~ n rows, ~~of said color filters~~, said method comprising the steps of:

(a) ~~classifying (m*n) rows of photoelectric converter elements as one set, selecting a plurality of units of photoelectric converter element rows, which are symmetrically distributed, respectively from said sets of photoelectric converter element~~

~~rows,~~ reading first electric charges ~~charge~~ from a first group of photoelectric converter element rows which have an asymmetric distribution with respect to any one row of the group, ~~in said unit thus selected and feeding the electric charge~~ into said vertical charge transfer channel regions;

(b) transferring the read-out first electric charges ~~charge for~~ [[j]] jxn rows, where j is an integer greater than one, after said readout step (a); and

(c) reading second electric charges ~~charge~~ from a second group of photoelectric converter element rows which have an asymmetric distribution with respect to any one row of the group, at positions jxn rows downstream from the rows of said readout step (a), ~~to which the electric charge is transferred by said transfer step (b), feeding the electric charge to~~ into said vertical charge transfer channel regions, ~~and adding~~ to respectively add the read-out first and transferred second electric charges of a same color to each other in said vertical charge transfer channel regions,

said first and second readout steps (a) and (c) being capable of reading electric ~~charge~~ charges from two rows ~~contained in~~ of one unit of photoelectric converter element rows.

7. (Currently Amended) The method of controlling a solid-state image pickup device according to claim 6, wherein:

said n is two;

said ~~m~~ j is ~~four~~ m/2; and

~~said selected units selected by~~ said readout steps ~~step~~ (a) and (c) ~~are~~ read two units per said set.

8. (Currently Amended) The method of controlling a solid-state image pickup device according to claim 7, wherein:

said ~~selected units are obtained from~~ reading steps (a) and (c) read every second unit;

said ~~readout~~ reading step (a) reads ~~is conducted for~~ a second row of a ~~first selected~~ first unit and ~~for~~ a first row of a second ~~selected~~ unit; and

said ~~readout~~ reading step (c) ~~is conducted for~~ reads a first row of said ~~first selected~~ first unit and ~~for~~ a second row of said second ~~selected~~ unit.

9. (Currently Amended) The method of controlling a solid-state image pickup device according to claim 6, wherein:

said n is three;

said m is six; and

~~said selected units are three units per said set,~~ said method further comprising the steps of;

(d) transferring the added electric charges ~~charge~~ for [[j]] jxn rows after said second reading ~~readout~~ step (c); and

(e) reading third electric charges ~~charge~~ from a third group of photoelectric converter element rows which have an asymmetric distribution with respect to any one row of the group, at positions jxn rows downstream from the rows of said reading step (c), ~~to which the electric charge is transferred by said j-row transfer step (d), feeding the electric charge~~ to said vertical charge transfer channel regions, ~~and adding~~ to

respectively add the read-out third and transferred added electric ~~charge~~ charges of a same color to each other in said vertical charge transfer channel regions.

10. (Currently Amended) The method of controlling a solid-state image pickup device according to claim 9, wherein:

~~said selected units are obtained from every second unit;~~

said ~~readout~~ reading step (a) ~~is conducted for~~ reads mutually different rows of ~~selected~~ first, second, and third units at every second unit; and

said steps (a), (c), and (e) read electric charges ~~charge~~ from a first row, a second row, and a third row of said ~~selected~~ first, second, and third units, respectively.

11. (Currently Amended) A solid-state image pickup device, comprising:

a semiconductor substrate having a two-dimensional plane on a surface thereof;

a plurality of photoelectric converter elements arranged in the two-dimensional plane in a matrix configuration having rows and columns;

an array of color filters including a plurality of units, ~~one color layout~~ each unit consisting of two adjacent photoelectric converter element rows ~~as one unit~~, said units ~~unit~~ being repeatedly and contiguously arranged in said array in a column direction, in which one color filter of the array ~~thereof~~ is formed over each of said photoelectric converter elements, wherein, the first row of each unit has ~~said two rows including a row of~~ a first color layout of color filters arranged in a row direction and the second row of each unit has ~~a row of~~ a second color layout of color filters arranged in ~~a~~ the row direction, said second color layout being different from said first color layout;

one vertical charge transfer channel region formed in said semiconductor substrate for each of the columns of said photoelectric converter elements, adjacent to said each column;

a plurality of vertical charge transfer electrodes in which two vertical charge transfer electrodes are disposed over said vertical charge transfer channel regions for each of the rows of said photoelectric converter elements; and

a drive circuit capable of applying readout pulse voltages to

said vertical charge transfer electrodes corresponding to said photoelectric converter element row having said first color layout in a first unit ~~photoelectric converter element row pair of two photoelectric converter element rows adjacent to each other in a column direction~~ and to

said vertical charge transfer electrodes corresponding to said photoelectric converter element row having said second color layout in a second unit ~~photoelectric converter element row pair of two photoelectric converter element rows adjacent to each other in a column direction~~, said second unit ~~photoelectric converter element row pair~~ being at a position apart from said first unit ~~photoelectric converter element row pair~~ by two photoelectric converter element rows in the column direction.

12. (Original) The solid-state image pickup device according to claim 11, further comprising a variable barrier formed in said semiconductor substrate below said photoelectric converter elements,

said variable barrier being capable of modulating an amount of electric charge accumulable in each of said photoelectric converter elements.

Claims 13 - 14. (Cancelled)

15. (Currently Amended) A method of controlling a solid-state image pickup device, comprising a semiconductor substrate having a two-dimensional plane on a surface thereof;

a plurality of photoelectric converter elements arranged in the two-dimensional plane in a matrix configuration having rows and columns;

an array of color filters including a plurality of units, ~~one color layout~~ each unit consisting of two adjacent photoelectric converter element rows ~~as one unit~~, said units ~~unit~~ being repeatedly and contiguously arranged in said array in a column direction, in which one color filter of the array is formed over each of said photoelectric converter elements, wherein, the first row of each unit has ~~said two rows including a row of~~ a first color layout of color filters arranged in a row direction ~~in which one color filter thereof is formed over each of said photoelectric converter elements~~ and the second row of each unit has ~~a row of~~ a second color layout of color filters arranged in ~~a~~ the row direction, said second color layout being different from said first color layout;

one vertical charge transfer channel region formed in said semiconductor substrate for each of the columns of said photoelectric converter elements, adjacent to said each column;

a plurality of vertical charge transfer electrodes in which two vertical charge transfer electrodes are disposed over said vertical charge transfer channel regions for each of the rows of said photoelectric converter elements; and

a drive circuit capable of applying readout pulse voltages to

said vertical charge transfer electrodes corresponding to said photoelectric converter element row having said first color layout in a first unit ~~photoelectric converter element row pair of two photoelectric converter element rows succeeding one after another in a column direction~~ and to

said vertical charge transfer electrodes corresponding to said photoelectric converter element row having said second color layout in a second unit ~~photoelectric converter element row pair of two photoelectric converter element rows contiguous to each other in a column direction~~, said second unit ~~photoelectric converter element row pair~~ being at a position apart from said first unit ~~photoelectric converter element row pair~~ by two photoelectric converter element rows in the column direction;

said method comprising the steps of:

a) classifying said vertical charge transfer electrodes into sets each of which includes 16 vertical charge transfer electrodes as one set, said 16 vertical charge transfer electrodes ranging from a first vertical charge transfer electrode to a 16th vertical charge transfer electrode succeeding one after another, and

applying readout pulse voltages to

said vertical charge transfer electrodes belonging to said photoelectric converter element row having said first color layout of said first unit ~~photoelectric converter element row pair including two rows adjacent to each other in the column direction~~, said first unit ~~row pair~~ being selected from each said set and to

said vertical charge transfer electrodes belonging to said photoelectric converter element row having said second color layout different from said first color layout of said second unit ~~photoelectric converter element row pair including two rows adjacent to~~

~~each other in the column direction~~, said second unit ~~row pair~~ being formed in positions beginning at a position apart from said first unit ~~photoelectric converter element row pair~~ by four photoelectric converter element rows in the column direction;

b) transferring the signal charge read out by said step a) through said vertical charge transfer channel regions for four photoelectric converter element rows in column direction;

c) applying readout pulse voltages to said vertical charge transfer electrodes belonging to said photoelectric converter element rows of said first and second units ~~photoelectric converter element row pairs~~, which ~~said photoelectric converter element rows being~~ are not used to read the electric charge therefrom in said step a); and

d) transferring the electric charge read out in said step c) and the electric charge read out in said step a) in said vertical charge transfer channel regions.

16. (Original) The method of controlling a solid-state image pickup device according to claim 15, wherein said device further comprises a variable barrier formed in said semiconductor substrate, said variable barrier being capable of modulating an amount of electric charge accumulable in each of said photoelectric converter elements, said method further comprising the step of

x) modulating by said variable barrier an amount of electric charge accumulable in each of said photoelectric converter elements to one half of an original amount thereof before said step a).

Claims 17 – 18. (Cancelled)